Notebook Series -- Notebooks by Edison
Notebook, N-18-11-03

This notebook was used by Edison in November 1918 in connection with work performed for the U.S. Navy during the World War I. Included are notes on acoustical experiments with various resonators, along with notes taken from the works of Herman von Helmholtz, Alfred M. Mayer, and other published sources. Some of the experiments were performed on the lawn at Glenmont, Edison's home in Llewellyn Park, and others in various buildings at the West Orange laboratory. One entry contains a speculation by Edison that his deafness gives him an advantage in hearing changes in the volumes of sounds. The entries indicate that William A. Hayes, Sherwood T. (Sam) Moore, and Frederick P. Ott assisted on some of the experiments. The pages are unnumbered. Approximately 50 pages have been used.

Bad	good
27	42
50	57
31	86
86 —	42
28	

43 — 86

16 $\frac{1}{16}$

16 — 16

256

126

$\frac{3}{16}$ | $\frac{257}{853}$ — (.534"

$\frac{5}{16}$ | $\frac{257}{514}$ (3.21"

$\frac{7}{16}$ | $\frac{257}{367}$ (2.29"

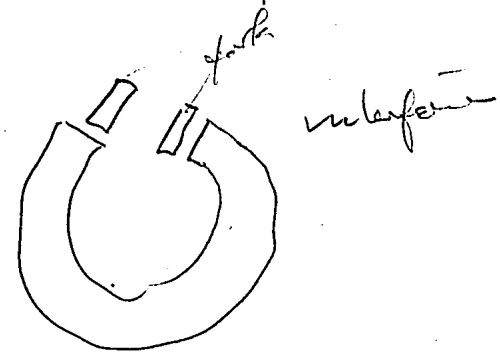
$\frac{9}{16}$ | $\frac{257}{2.8}$

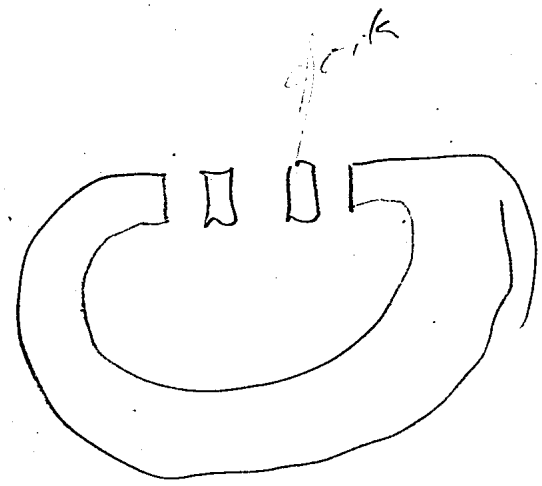
75428
Office Co.,
MFG. STATIONERS,
96 JOHN ST.
AND
19 PLATT ST.
NEW YORK

7°

Resonators

2 Resonators (Closed)
when placed at right
angles to each
other interfere when
Qracking from a
Tuning fork
because of of phenomena





in phase gives double loudness of an open tube

its the waves that dont go in the tube that is heard

Kane 251

July to Dec phil mag 1841 —

No sound no matter how intense
Can diminish or obliterate the
sensation of a concurrent sound
which is lower ~~the~~ in pitch.

(1 E) high notes sound dont
prevent hearing low notes
sounds — Mayer 1876 Phil Mag
503.

Does a strong low obliterate a weak high

~~I gave to the~~

Kundt says VE sound
~~[illegible]~~ ½ atmos
pressure in a tube of
glass. of 2½ atmos is
4 meter greater with
2½ atmos

the reason he says is that heat is not lost to walls of tube at 2½ atmos as fast as with 1/2 atmos,

Del Sound in soft Rubber is remarkable 30 to 60 meters second, the same rate as nerve impulses in the body -

Rayleigh think mainly loss of loudness is due to motion from the walls of the pipe

But says there are other losses,

Note we can test loss in Resonator tubes by putting in a music box & closing it light & listen outside

At perpendicular incidence short sound waves are more copiously reflected than those longer & ray reflection is more copious from large than from small surfaces

With a given 60 000 vibs
a second been perceived
yet beyond this the
the sensitive flame
acts powerfully.
Pouillon 1843 -
Phil Mag.

Hedrulez - More perfect
elasticity seems peculiarly
to favour the Continuance
of rapid vibration & are in
general more quickly
deadened by imperfect
elasticity & friction than
slower vibrations -
Thus rubber rods only give
sounds an octave from music box

Warburg obtained May 30
1870 — says rubber
tubing lasting when
long dampens out
high notes while
low notes heard OK
~~depends on diameter~~

for the same thickness of the
sides of Rubber Tubes
the enfeeblement of the tones
on Conduction Experiment
the higher ones, diminishing
~~dim~~ with an increase
of internal dia
with 2 mid tubes 1 small
dia one large put on
tone, by pinching the

found that the higher
notes pass more
readily from small tubes
than from the wider
? This is due to yielding of
the larger tubing –

(1e) just as Dolphin –
+ sound is lost to ear
by passing to our
outside

Helmholtz says softness
of tone on wood instruments
is due to this while
brass tubes not yielding
preserve all the high
harmonics + harsh stuff

with Hydrogen much longer
Resonant tubes required
Energy of vibrating mass
of H so small it
can scarcely be heard

Nov 2nd

Preliminary Expts with Rings & broken pieces hung on Saw horse & suspended by strings & struck by felt hammer

18" brass column 10" of which is a removable Extension — The 8" proper contains at Bulbous end phone disc & listening tube, at node

I move it up & down by a screw with index

Big iron ring hear at 10 7/8"
The Big lever for foot press cant get.
Small split ring - 14 1/8"
get response
Broken iron bar. hear at about 10"
The Bearing - hear nothing

I now remove the
10" Extension —

Hear at 3" 3/16 on big ring —

Small steel ring split
get it OK at 4 1/8
has 3/8 Manipu

Brass ring Can't hear
music but hear
knock at 4 5/8 =

Notice a phenomenon
just before I reach
the musical timbre
I hear the knock of the
Hammer, The musical
timbre covers from 2 to 3/8
whereas the knock covers
3 to 5 1/8

On the brass rump, 4 7/8
is loudest knock & faint music
bumper 1 at 6 5/8 get
big musical round
Can hear it over a range of
5 @ 6/8 —

Broken bar hear common
knock + music at 7"
but it has 3/4 range —

Knock slight musical at 2 7/16

Long foot press bar: hear knock
over 3 to 5 inches, + its an echo
tone varies, at one spot 1/2 long
get slight musical range —

Bearing — only knocks
over range of 1 1/2"
Nothing musical

Taking the note on 8" Column heard from brass ring, which had good musical quality I listened to diaphragm using rubber tube or also thru small brass tube stuck into top of Column, there is accurately any difference in the Volumes

Nov 3 1918 Sunday

Experiments made in Disc Research Bldg-

C 256 Vibs. Ash Can generator

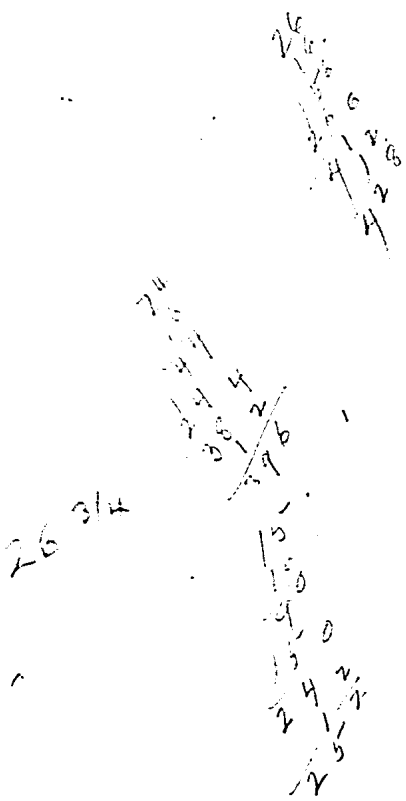
5¼ - Brass tubing, Normal opening at top 2"

All brass listening tube best,

Limit at 14½ air Column 44½ inches, (old C whistle) my cold so worse ~~As~~

then for some unknown reason Couldnt get it at 24 inches we clean out the Column as may be dirt on water Column,

1/8 above or below 14½ throws it out of tune



Best distance now is 18½ inches, something wrong somewhere my Cold or Echo interference in Room -

With the 2" glass tube air - get it at 24 3/4 - same air Column 15 3/4 - 5/8 hole.

Same but with ½" hole in Top - Column length 15 3/16 - Limit sure 26 3/4 inches.

Same but with 3/8
hole at Top —
Column — 14 11/16
Limit 35 inches —

Same but with 1/4
hole at Top — Column
14 3/16 — Limit 16 3/4"
now overlong
With other tone, 1st overlong
1 1/4 Opening — Limit 36 1/2
Column 4 3/16 —

Same but with 1 inch
Opening on Top —
Limit 32 1/2 Column
3.5/8 —

3/4
16/6
7
5 0
3/16
5

16 3/4

14
16
1/4
8
14/4
7 1/3
3
7

14 3
16
84
14
224

3 | 227 | 4.8 1/2
16 | 76
64
12 0

Dia of glass tube inside 2 5/16 —

Dome with 3/4 Opening at Top. — Limit 29 3/4 —

Column 2 13/16

ditto 5/8 Limit 28 1/2

Column 2 3/8

ditto 1/2 Limit 28 1/4

1 15/16 -

ditto 3/8 - Limit 19 1/2

1 3/8 -

We now go back to fundamental
tone = $1\frac{1}{4}$" opening at Top.
Cant get at foot opening

ditto. 1" Top Cant get

ditto 3/4 Hole - Limit $16\frac{1}{4}$
$15\frac{1}{4}$ Column -

ditto 5/8 - Hole 27 3/4 limit
Column 15 3/4

With 5/8 hole & put on a
3" long 5/8 pipe Cant get
Either fundamental
or overtone -

Now have 1½" hole on top
put 00z diaphm over
hole, too weak to get
either fundamental or
overtone –

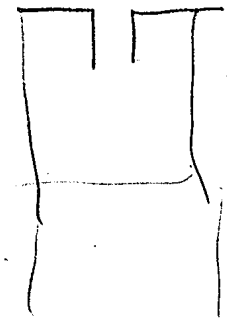
Brass, Brass Res – 2"
5/8 Hole top –
Column 16¼ –
Limit 26 inches.

ditto 3/8 hole top –
Cant get

ditto ½" Cant get
yet 5/8 is OK – when tried
some reduction somewhere

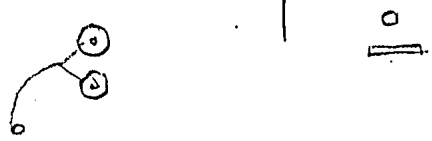
We now take off the 10" Extension + try for the overtone $2\frac{15}{16}$ air Column 28" Limit - using 5/8 hole at top -

With Brass Diaphr 8" Res 2" dia put a 5/8 hole in top but attached a tube to hole the tube Extending into Resonator

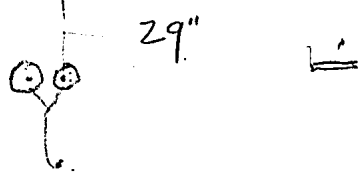


got nothing

2 2" glass Res 5/8 hole
tuned to prime line -
1 to 15 9/16 other 15 13/16 -
Limit 29 inches -



Which put tubes thus -



See no advantage in 2 tubes
in Multiplex one ear tube -

I now put 2 of glass jars in multiple one turned to prima & other the ylt for overtone,
Limit. 33 inches –
This is really a little better –
The ylt is 2 5/16 Column
The prima is 15 3/4 –

Using same glass jar in order we blew the 1st note of the gamut of reeds – Column 11 1/4 inch for prima –
Limit 39" ? Extreme

$11\frac{1}{4}$
10
X
$7\frac{11}{16}$
$6\frac{7}{8}$

$11\frac{1}{4}$
$10 \cdot \frac{11}{16}$
7
$6\frac{7}{8}$

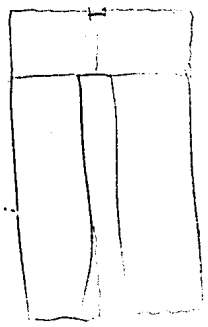
We now show the 2nd Road of giving

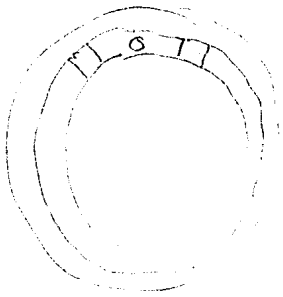
Column 10 inches

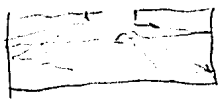
Limit $12\frac{1}{2}$

We need show the 3rd too weak to adjust.

I found these reeds require more more power to blow as you go up in scale. hence unpractical to test with Constant air pressure,







We try the 4th one which is louder prime is –
$7\frac{11}{16}$ – limit $9\frac{1}{4}$ inches

We now try the 5th – weaker
Column $6\frac{7}{8}$ limit – $4\frac{1}{4}$

Now the 6th
Can get it
too weak on prime but
hear overtone $1\frac{5}{8}$ column
Can hear it several ft
10ft or more +
I notice DE or 6th one is much louder
than the others I hear it by ear
twice as far away

Just found something ~~[illegible]~~
NE ~~[illegible]~~

FF is No 1 —
GG No 2
AB No 3 This is number
BG No 4 was blown
CD No 5
DE No 6

In blowing no. 6 - the partial is 1 5/8 and quite loud, louder than partial of old C, louder yet
When I recede from Reed I lose it but as I pass further away I

get it again, then further on
Silence. then further on
loud again & can hear
plain at End board 10ft 9"
& could pbly hear it further

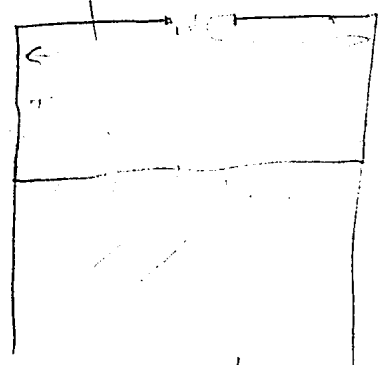
With old C tuned to
overtone acts same way
Can go 6 to 7 ft.
There are nodes of silence
to me, but not to Fred
Ott.

Evidently I have discovered by
reason of my deafness the Very
Considerable rise & fall of
Volume of Sound not perceptible
by normal Ears when resonators
in various distances from the

Source of sound are moved slightly towards & from the source, & where I find silence there is a node or antinode which works against the pendulum motion of the air going in the resonator, (ie) the waves in the resonator is not in time with the air waves. This is very strong. Whereas my best results were 30 inch from the little end turning whistle I now get 12 ft by moving resonator from position of silence to position of audibility.

I shall have to try all the experiments over again since I have found this & then duplicate them in the open air —

Note = As the very loud overtone from # 6 Reed pipe is the loudest of all yet heard even louder than C + the length of Column is 1=5/8 whereas the width of the glass jar is 2=5/16 it is evident the width of a Column can be greater than the height, or perhaps the Column was working the other way



Cross ways + it was either 2 5/16 long — or the order was in multiple one of just half of 2 5/16 or 1.5/32 — If this is true This is another discovery

It will require a peculiar "Escape" ~~[illegible]~~ of resonator to be made.

This will be valuable for extending the range of resonators for very high notes as column gets too short to be practical.

The real cause is this, probably if we put a resonator at any fixed distance from the source of sound and tune it to give the best maximum volume you must keep it there, for if you recede the sound waves will not coincide, and its volume will diminish, but you can recede

and find a point of accordance and
will regain its Volume minus the
diminution due to the distance,

It also may be due to uneven blowing, a little
harder blowing brings in an overplus
(not there when blown at each other) 10s
may have been for

~~12 best~~ Right sides = 7

I found on
trying to test with DE & glass
CC measure that our quadrant
does very uneven pressures
& therefore measurements of
Volumes is out of the question

35

7 | 18.5
4.5

32 7 | 153
2.18

14 | 15.3 (14
14
4 3

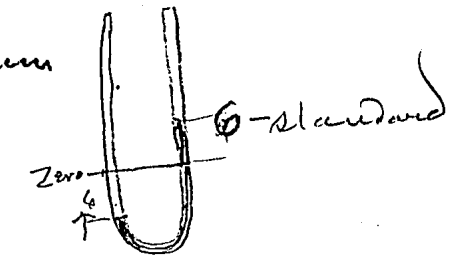
63 13 | 153 (9.
13.3

0

16
16
96
16
23.6 17 | 261 (15.3
17
9.5
8.6

Nov 4 1915

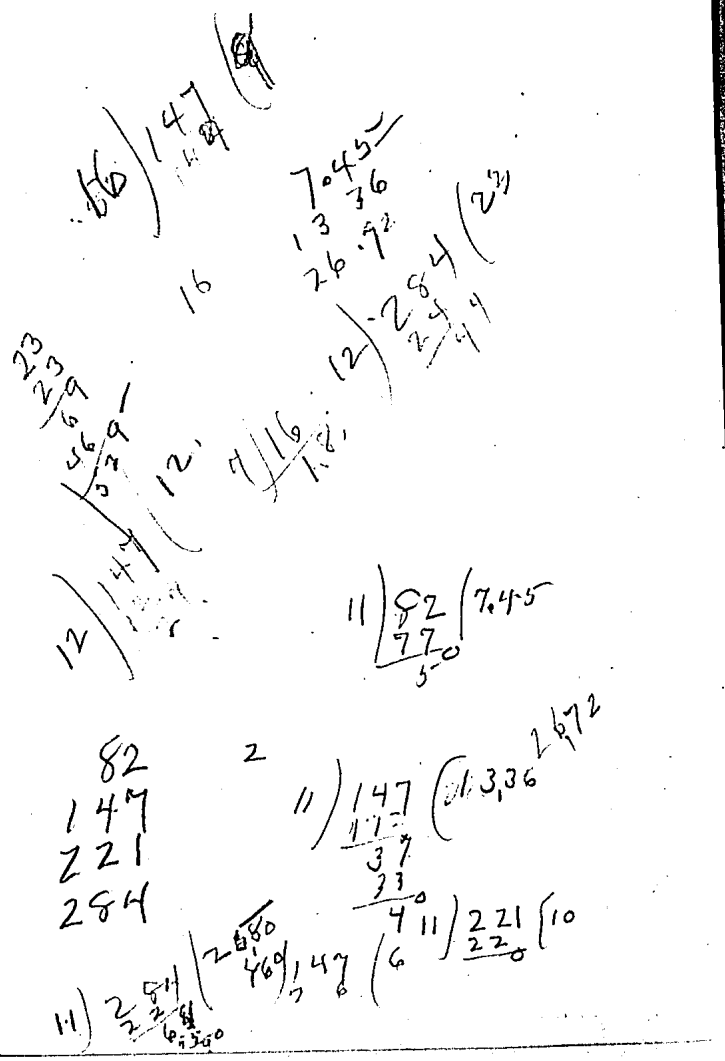
We now blow the Reeds with Compressed air from Ambrosia second dept. We use a water gauge & adjust air pressure ~~to~~ 5" on water Column



Fred Oft found a note 11/16 on 1000 cc par - blowing middle C. We have been using

We now keep the water 6" above Zero of both Columns

Tuned to Hayes, C 256 —
Column $16\frac{1}{16}$ —
49 — get nothing
84 Very strong
Edison hears Reed
11 inches
32 " obtained over ear
to make resonant Cavity
11 inches when both ears Closed
by fingers
further Edison can hear
with $16\frac{1}{16}$ Column Sure is
100 inches — but 82 is Very
plain + absolutely unmistakable
but at times dont hear
it but generally do — Over.



air supply must be regular
put in a Carboy for equalizing
Reservoir – Can hear at
100"
hear even louder at 147
We shall have to lengthen
our Index board
It looks as if the
variations at different
places along the index
is due to Echos Commandeering
or not with the Reservoir
I get it at 221
243
also 284 strong

7)16/2

7)256/36

9)256/28

11)256/236 (2.3

also get the ~~C~~ 11th partial
. The Column being 2 5/16 -
prime being 16 1/16 =

6th Nov - Moores steel
Reed - C# next middle C
Gasometer = to much
stronger than the
little grand liners
14 1/4 = Resonating
Column 1000 c c gal
Reed is 12/1000 lbs
~~C#~~ 3/16 wide - dia pipe
7/16 inside - length reed
about 3/4 ~ pipe 2 3/4
long -

I got a whole length of
index board but only
at 0 pots, I put fingers
over hole off + on to
make it glacier

Can hear at 35 meters without
hand on Ear — hear 25
feet very strong using
the Overtone 2" air Column

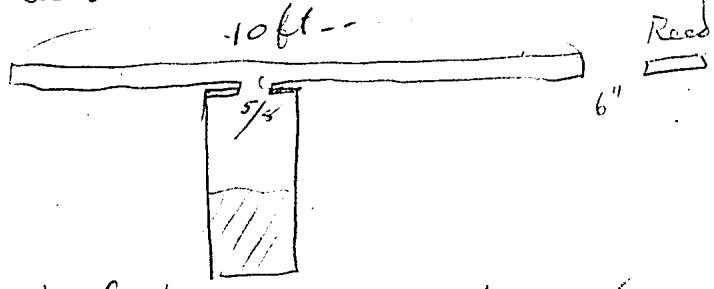
Can go into Dunwoodie
room 35 ft + hear it.

There are spots where cant hear
all over —

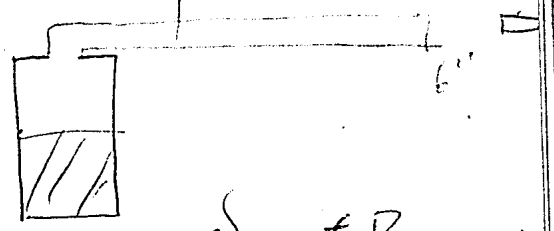
There is Echoes Resonance of
the whole room —
Its impossible to adjust Resonation
in a Room —

Nov 7 = 1918

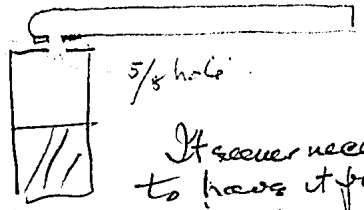
Cannot get resonate. Tube 3/4 tube connected thus



hole half way - at no place can get resonance



at no place could get Resonance



about got resonance Often went several ft away

It seemed necessary to have it free to air -

With 1000 CC jar. 2" air Column
5/8 hole

& a 3" 3/8 measure lin jar -
with 1/2" hole - The air Column
is 11/16 = There is very little
difference in Column
& in favor of the 3 & 3/8 jar
length of Column or width
has very little to do with
it. Evidently -
with 5/8 hole in the 3 3/8 jar
air Column 15/16 -

With Hollands fork in box

$3\frac{3}{8}$ lbs jar — 6" 9 thick

Opening on top	Length of Column of air in
$1\frac{1}{4}$	$2\frac{1}{4}$
1	$1\frac{3}{4}$
3/4	$1\frac{1}{4}$
5/8	1
1/2	3/4
3/8	1/2

after 5/8 to 3/8 the it weakens
It weakens about 1 inch —
test this weakening —

The 2 5/16 wooden tube —

5/8 opening	air Column for 7th co
1c	2"

The Brass Mechanical conformation 2" dia
$1\frac{1}{4}$ Hole Column 4.3/4
2" flange of tube 5.7/8

Nov 9 1918
Hollands tuning fork — Vibs Sec
prime on 1000 c c
jar — $15\frac{1}{4}$ inches
overtone is 2 inches

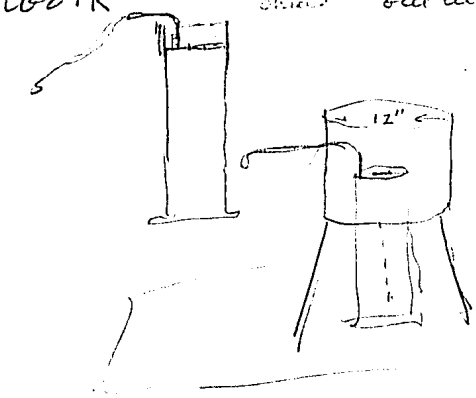
Hollands fork hereafter

The 6" jar, Can get a 7th from Hollands fork with 1/4" Column by proper hole,

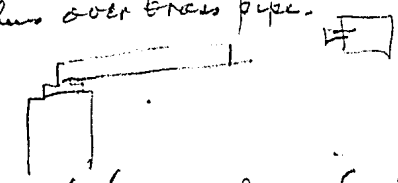
Adjust & get all the Columns with Variable holes on 2 5/16 1000 cc jar 3 3/8 jar 6" jar + Brass screw jar + the 1 1/2" glass jar —
Then Make Corrons —

1

2 = See if a shield for wind will work



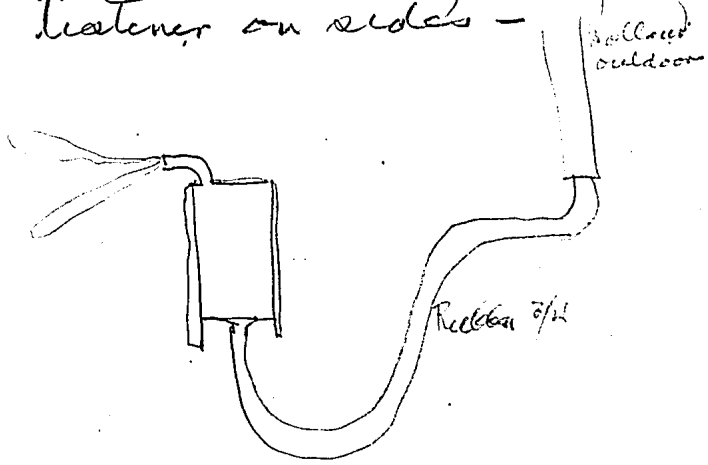
Try too much diaphrm over brass pipe.



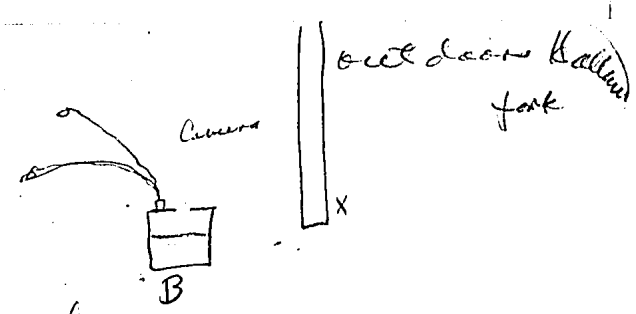
Idea Hayes make hearing seconds —

Get other forks & put Micros on —

Taper hole in 2" or more dia
3/8" down to 3/16 —
6" long —
where Camera shutter on
Brass tube used put taper
fastener on sides —



Cant find any resonant spot,
no matter what change
on this Cant find a
resonant spot, Except opening
at tap —



Right under X 1" away can't hear anything more To B 1 ft away get it 3 ft away better —

We now making a small Echo vocation box 10" wide - 66" inches long with hinged cover at one End is X + other End a sliding Echo board + Resonators can be placed anywhere along the 66 inches

Ear 7 = 49

tube 18 324

49 | 324 | 6.6 times
294
30 better

18
18
144
18
324

Hope to find out where Drums & Echoes work together without closing and Energy and in the room —

Hallard —
17/100 of amp
4 cells B 2 —
Edisons Lunt 18 ft
with brass tube
3" air Column
2 listening tubes 1 ft long
Edison by Ear 7 ft 18

Nov 18th 1918

1st test open field id
Edison Lamp
Binaural tube 2 listeners
tubes Moore
328 ft.
By ear 148 ft
Resonators 4.9 times
better - or 1.20 times
as far as twice as
far in air -
I turned the 1000 cc
jar to prime tone about
$15\frac{1}{2}$" + Moore
count 60 or more ft
I could have gone
more if Rain hadn't
stopped us - To me
the prime tone is not
1/2 as loud but to
normal ear it
carries further probably
not in tune with any
voice like the 4th +
will use prime of 4th +
2 Pair tubes

Moore says when listening with separate tube to each ear one for prime & one for 7th - That it is certainly twice as loud as listening from 1 tube with one ear

& that there is very little difference in hearing between two prime tone tubes 1 for each ear & 1 prime & 1 7th - Thinks tube to each ear 1 from prime & one from 7th is slightly louder

says the octavine needs more drill in prime & sharp like cream in 7th -

82
147
221
243
284

56— 40 24 120 | 240 (20

23 17 40 — 550—

46.6 333 20.0 999 1300 100— 1300

21 15 279.6 1998 120.0—

120 | 560 (46.6

17 7 24

283 grms NaOH

283 grms NaOH alkali

1350 27 5 0 2700 283

1.440 | 360 (1.47

133

39 17 56 100—

550 2400 3.6—

9

36 | 870.0 (24

214 36 284 144 0 7 4

870 — 3.6 | 876

870 81 89 696.0 0.47

870—

704 Copper

2.92 Copper

C 450 90 450 36 54

Cu O 65 — 12 41 6 100 65 50 65 50 65 50

65 — 12 41 6

450 65 50 65 50 65 50

3.6 50 160 234

Cu O

242 65 0 145 145 65

65 34 99 100.

430 860— 450 90 260— 81 65 40 465 5 21 450 90 3.6

65— 190 260

81 | 870 (10.75

81 | 650 (8.

157 | 870

Cu O 65— 12 41 6 100 65 50 65 50

2.92 Copper

C 450 90 450 36 54

870 81 89 696.0 0.47

870 — 3.6 | 876

3.6 50 160 234

Cu O

242 65 0 145 145 65

65 34 99 100.

430 860— 450 90 260— 81 65 40 465 5 21 450 90 3.6

65— 190 260